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EXAMINER	
ARCIERO, ADAM A	
ART UNIT	**PAPER NUMBER**
1795	
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Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Office Action Summary	Application No.	Applicant(s)	
	10/519,548	GERRITSE ET AL.	
	Examiner	Art Unit	
	ADAM A. ARCIERO	1795	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE _3_ MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on _26 May 2009_.

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) _1-7 and 9-22_ is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) _1-7 and 9-22_ is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☐ The drawing(s) filed on _____ is/are: a)☐ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☐ Notice of References Cited (PTO-892)

2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)

3) ☐ Information Disclosure Statement(s) (PTO/SB/08) Paper No(s)/Mail Date _____.

4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____ .

5) ☐ Notice of Informal Patent Application

6) ☐ Other: _____.

BIOFUEL CELL

Examiner: Adam Arciero S.N. 10/519,548 Art Unit: 1795 July 30, 2009

Continued Examination Under 37 CFR 1.114

1. A request for continued examination under 37 CFR 1.114, including the fee set forth in 37 CFR 1.17(e), was filed in this application after final rejection. Since this application is eligible for continued examination under 37 CFR 1.114, and the fee set forth in 37 CFR 1.17(e) has been timely paid, the finality of the previous Office action has been withdrawn pursuant to 37 CFR 1.114. Applicant's submission filed on May 26, 2009 has been entered.

2. The text of those sections of Title 35, U.S. Code not included in this action can be found in a prior Office action.

Claim Rejections - 35 USC § 112

3. The claim rejections under 35 U.S.C. 112, second paragraph, on claim 3 as being indefinite is withdrawn, because Applicant has amended claim 3.

Claim Rejections - 35 USC § 102

4. The claim rejections under 35 U.S.C. 102(b) as being anticipated by HABERMANN et al. on claims 1, 4-6, 9-11, 13-14, 16-17 and 19-20 are withdrawn, because Applicant has amended independent claim 1.

Claim Rejections - 35 USC § 103

5. The claim rejections under 35 U.S.C. 103(a) as being unpatentable over HABERMANN et al. and RICHTER et al. on claim 12 is withdrawn, because Applicant has amended independent claim 1.

6. The claim rejections under 35 U.S.C. 103(a) as being unpatentable over HABERMANN et al. on claim 15 is withdrawn, because Applicant has amended independent claim 1.

7. The claim rejections under 35 U.S.C. 103(a) as being unpatentable over KIM et al. and CHAO et al. on claims 1, 4-7, 9-10 and 21 maintained.

As to Claims 1, 4-7, 10 and 21, KIM et al. discloses the method for conversion of waste water (organic waste) (pg. 4, lines 51-56). The waste is introduced into the cell which comprises an anode compartment and cathode compartment separated by a sintered glass separator (pg. 5, lines 18-19 and Fig. 1). As shown in Figure 1, air (oxidizer) is fed into the portion of the cell around the cathode, and a potential difference is formed across said pair of electrodes (Figure 1) and carbon dioxide is inherently produced at the anode and electricity is produced. KIM et al. also discloses a kit for processing organic waste comprising an anode and cathode (three dimensional electrodes) wherein the electrodes can be graphite felt electrodes (pg. 5, lines 14-17). KIM et al. does not expressly disclose that the sintered glass separator is a porous, electronically non-conductive, non ion-selective partition wall.

However, CHAO et al. teaches that separators may be used in electrochemical cells (i.e. fuel cells) to separate the anode from the cathode (col. 5, line 67 to col. 6, line 1). CHAO et al.

further teaches that the separator is preferably permeable to the electroactive species and preferably completely chemically and physically stable in the cell environment (col. 6, lines 7-10). Suitable separators include sintered glass, inorganic ion-exchange membranes, and woven and non-woven fabrics made from fiberglass (col. 6, lines 10-14).

At the time of the invention, a person having ordinary skill in the art would have found it obvious to substitute a non-woven fiberglass separator (porous, electronically non-conductive, non ion-selective partition wall) for the sintered glass separator of KIM et al. because the two are known substitutes which provide for good separation of the anode and cathode in a fuel cell so as to reduce the rate of flow of electroactive species and electrochemical products, thus minimizing the reconversion of electrochemical products, as taught by CHAO et al. (col. 5, line 67 to col. 6, line 4). It would have been obvious that the substitution of one known element for another would have yielded predictable results to one of ordinary skill in the art at the time of the invention. CHAO et al. recognizes that sintered glass separators are equivalent to woven and non-woven fabrics such as fiberglass that can be used as a separator in an electrochemical cell between and anode and a cathode.

As to Claim 9, the electrodes are inherently three-dimensional electrodes because only three physical dimensions are perceived on Earth, and since the electrodes are physically present, they occupy three-dimensions only.

8. The claim rejections under 35 U.S.C. 103(a) as being unpatentable over KIM et al. ('061) and CHAO et al. on claims 1, 4-7, 9-10, 17 and 21 maintained.

As to Claims 1, 4, 7 and 21, KIM et al. (‘061) discloses the method for the conversion of waste water (organic waste) wherein the waste water is introduced as a fuel into a biofuel cell consisting of a pair of electrodes (anode and cathode) and having an oxidizer introduced into the cathodic compartment and producing electricity and CO_2 off gas (Claim 4). KIM et al. (‘061) discloses a cation exchange membrane used to separate the anode from the cathode thereby forming an anaerobic compartment (anode side) and an aerobic compartment (cathode side). However, KIM et al. does not expressly disclose a porous, electronically non-conductive, non ion-selective partition wall used to separate the anode and cathode.

However, CHAO et al. teaches that separators may be used in electrochemical cells (i.e. fuel cells) to separate the anode from the cathode (col. 5, line 67 to col. 6, line 1). CHAO et al. further teaches that the separator is preferably permeable to the electroactive species and preferably completely chemically and physically stable in the cell environment (col. 6, lines 7-10). Suitable separators include sintered glass, inorganic ion-exchange membranes (cation exchange membrane of KIM et al. (‘061)) and woven and non-woven fabrics made from fiberglass (col. 6, lines 10-14).

At the time of the invention, a person having ordinary skill in the art would have found it obvious to substitute a non-woven fiberglass separator for the cation exchange membrane of KIM et al. (‘061) because the two are known substitutes which provide for good separation of the anode and cathode in a fuel cell so as to reduce the rate of flow of electroactive species and electrochemical products, thus minimizing the reconversion of electrochemical products, as taught by CHAO et al. (col. 5, line 67 to col. 6, line 4). It would have been obvious that the substitution of one known element for another would have yielded predictable results to one of

ordinary skill in the art at the time of the invention. CHAO et al. recognizes that ion-exchange materials are equivalent to woven and non-woven fabrics such as fiberglass that can be used as a separator in an electrochemical cell between and anode and a cathode.

As to Claims 5-6, KIM et al. ('061) discloses the oxidizer of claim 1 as being air, containing oxygen (pg. 6, lines 5-9).

As to Claim 9, the electrodes are inherently three-dimensional electrodes because only three physical dimensions are perceived on Earth, and since the electrodes are physically present, they occupy three-dimensions only.

As to Claim 10, KIM et al. ('061) discloses that the cathode and anodes of the biofuel cell consist of a graphite felt (pg. 5, lines 29-31).

As to Claim 17, KIM et al. ('061) discloses that starch wastewater and an anaerobic sludge is used in the anodic compartment of the biofuel cell where electrochemically active bacteria produce electric current while using the organic substances in wastewater as a fuel (pg. 6, lines 22-24). The cation produced from the anodic compartment is passed through the separator membrane which divides the anode from the cathode, and arrives at the cathode (pg. 6, lines 25-29). The cation is converted into water in the presence of oxygen, allowing electric current to be continuously produced (pg. 6 lines 30-33).

9. Claims 2-3 and 19-20 are rejected under 35 U.S.C. 103(a) as being unpatentable over KIM et al. ('061) and CHAO et al. as applied to claims 1, 4-7, 9-10, 17 and 21 above, and further in view of DAHLBERG (US 4,344,832).

As to Claims 2-3, the combination of KIM et al. (‘061) and CHAO et al. does not specifically disclose two or more pairs of electrodes configured in a bipolar stacked design, also having multiple partition walls.

However, DAHLBERG et al. discloses a fuel cell using a bipolar construction (at least two adjacent fuel cells electrically connected). At the time of the invention, it would have been obvious to one of ordinary skill in the art to modify the biofuel cell of KIM et al. and CHAO et al. with a bipolar stacked design, because stacked fuel cells will provide for a higher voltage output.

As to Claims 19-20, KIM et al. (‘061) discloses the method for the conversion of waste water (organic waste) wherein the waste water is introduced as a fuel into a biofuel cell consisting of a pair of electrodes (anode and cathode) and having an oxidizer introduced into the cathodic compartment and producing electricity and CO_2 off gas (Claim 4). KIM et al. (‘061) discloses a cation exchange membrane used to separate the anode from the cathode thereby forming an anaerobic compartment (anode side) and an aerobic compartment (cathode side). KIM et al. discloses that Fe-ions are introduced in the space around the cathode and said electrodes can comprise graphite (pg. 5, lines 24-31 and pg. 7, lines 25-26) However, KIM et al. does not expressly disclose a porous, electronically non-conductive, non ion-selective partition wall used to separate the anode and cathode.

However, CHAO et al. teaches that separators may be used in electrochemical cells (i.e. fuel cells) to separate the anode from the cathode (col. 5, line 67 to col. 6, line 1). CHAO et al. further teaches that the separator is preferably permeable to the electroactive species and preferably completely chemically and physically stable in the cell environment (col. 6, lines 7-

10). Suitable separators include sintered glass, inorganic ion-exchange membranes (cation exchange membrane of KIM et al. ('061)) and woven and non-woven fabrics made from fiberglass (col. 6, lines 10-14).

At the time of the invention, a person having ordinary skill in the art would have found it obvious to substitute a non-woven fiberglass separator for the cation exchange membrane of KIM et al. ('061) because the two are known substitutes which provide for good separation of the anode and cathode in a fuel cell so as to reduce the rate of flow of electroactive species and electrochemical products, thus minimizing the reconversion of electrochemical products, as taught by CHAO et al. (col. 5, line 67 to col. 6, line 4). It would have been obvious that the substitution of one known element for another would have yielded predictable results to one of ordinary skill in the art at the time of the invention. CHAO et al. recognizes that ion-exchange materials are equivalent to woven and non-woven fabrics such as fiberglass that can be used as a separator in an electrochemical cell between and anode and a cathode.

The combination of KIM et al. ('061) and CHAO et al. does not specifically disclose two or more pairs of electrodes configured in a bipolar stacked design, also having multiple partition walls.

However, DAHLBERG et al. discloses a fuel cell using a bipolar construction (at least two adjacent fuel cells electrically connected). At the time of the invention, it would have been obvious to one of ordinary skill in the art to modify the biofuel cell of KIM et al. and CHAO et al. with a bipolar stacked design, because stacked fuel cells will provide for a higher voltage output.

10. The claim rejections under 35 U.S.C. 103(a) as being unpatentable over KIM et al. (‘061), CHAO et al. and HABERMANN et al. on claims 11, 14-16 are maintained.

As to Claim 11, the disclosure of KIM et al. (‘061) in view of CHAO et al. as discussed in claim 1 above is incorporated herein. The combination of KIM et al. (‘061) and CHAO et al. does not expressly disclose one or more electrodes comprising active carbon.

However, HABERMANN et al. discloses active carbon cathodes that are employed for the method for a modified fuel cell type for treating waste waters (pg. 128, Summary and pg. 129, Electrolytes and electrodes). At the time of the invention, a person having ordinary skill in the art would have found it obvious to activate the graphite felt cathode in the biofuel cell of KIM et al. (‘061) and CHAO et al. so that the fuel cell is capable of continuous energy consumption using humus constituents or sugar waste as a fuel for over a period of five years without malfunction and maintenance, and purifying the waste water while producing energy, as suggested by HABERMANN et al. (Pg. 128, Summary).

As to Claim 14, HABERMANN et al. teaches that the cell is used for the determination and quantification of biological activity such as the TOC (total organic carbon) and COD (chemically oxygen demand) content in the degradation of waste waters with the fuel cell (pg. 132, Table 4). At the time of the invention, a person having ordinary skill in the art would have found it obvious to employ the biofuel cell of KIM et al. (‘061) and CHAO et al. as a sort of biosensor to determine and quantify biological activity within the cell such as COD and TOC content, as taught by HABERMANN et al. (pg. 132, Table 4).

As to Claim 15, HABERMANN et al. discloses in a working example of the operation of a biofuel cell for three days at 28 °C (pg. 132, col. 2). HABERMANN et al. does not disclose the method of claim 1, which is carried out at a temperature of 30-100° C, preferably 40-60° C.

However, at the time of the invention, it would have been obvious to one of ordinary skill in the art to have the biofuel cell of KIM as modified by CHAO and HABERMANN et al. operate at a temperature in the range of 40-60° C because, according to MPEP 2144.05, "a *prima facie* case of obviousness exists where the claimed ranges and prior art ranges do not overlap but are close enough that one skilled in the art would have expected them to have the same properties. *Titanium Metals Corp. of America v. Banner*, 778 F.2d 775, 227 USPQ 773 (Fed. Cir. 1985)." Furthermore, differences in concentration or temperature will not support the patentability of subject matter encompassed by the prior art unless there is evidence indicating such concentration or temperature is critical. "'Where the general conditions of a claim are disclosed in the prior art, it is not inventive to discover the optimum or workable ranges by routine experimentation.' *In re Aller*, 220 F.2d 454, 456, 105 USPQ 233, 235 (CCPA 1955) (MPEP 2144.05)." Furthermore, "a particular parameter must first be recognized as a result-effective variable, i.e. a variable which achieves a recognized result, before the determination of the optimum or workable ranges of said variable might be characterized as routine experimentation. *In re Antonie*, 559 F.2d 618, 195 USPQ 6 (CCPA 1977) (MPEP 21440.05)."

As to Claim 16, HABERMANN et al. discloses a method according to claim 1, wherein a series of inorganic ions were used as cations, for example trace elements such as iron (pg. 129, col. 2). At the time of the invention, a person having ordinary skill in the art would have been motivated to modify the fuel of KIM ('061) as modified by CHAO and HABERMANN et al.

with trace elements of iron as cations so that the demands for energy and nutrients can be met, as taught by HABERMANN et al. (pg. 129, col. 2).

11. The claim rejections under 35 U.S.C. 103(a) as being unpatentable over KIM et al. (‘061), CHAO et al. and RICHTER et al. on claim 12 is maintained.

As to Claim 12, the disclosure of KIM et al. (‘061) and CHAO et al. as discussed above in claim 1 is incorporated herein. The combination of KIM et al. (‘061) and CHAO et al. does not expressly disclose the limitation of one or more of the electrodes provided with a precious metal catalyst.

However, RICHTER et al. teaches a biofuel cell which uses a thin and small electrode comprising a platinum alloy catalyst such as platinum-aluminum (col. 2, lines 22-33).

At the time of the invention, it would have been obvious to one of ordinary skill in the art to modify the biofuel cell of KIM et al. (‘061) in view of CHAO et al. with a platinum alloy catalyst so as to minimize the size and weight of the electrode while maximizing the activity of the catalyst along with the mechanical integrity, as taught by RICHTER et al. (col. 1, line 64-col. 2, line 40).

12. The claim rejections under 35 U.S.C. 103(a) as being unpatentable over KIM et al. (‘061), CHAO et al. and HERTL et al. on claim 13 is maintained.

As to Claim 13, the combination of KIM et al. (‘061) and CHAO et al. does not expressly disclose the method according to claim 1, wherein one or more electrodes are provided with humic acid and/or anthraquinone-disulfonic acid.

However, HERTL et al. teaches a fuel cell which used suitable fuel solutions that comprise effective amounts of an electron-accepting quinone compound such as anthraquinone-2, 6-disulfonic acid. HERTL et al. further teaches that this compound is electrochemically reversibly and photoactive (col. 3, lines 37-48). At the time of the invention, a person having ordinary skill in the art would have found it obvious to use a fuel solution comprising effective amounts of anthraquinone-2, 6-disulfonic acid into the biofuel cell of KIM et al. ('061) and CHAO et al. so as to provide a provide a biofuel cell with a successful electron mediator, as taught by HERTL (col. 2, lines 46-56).

13. The claim rejections under 35 U.S.C. 103(a) as being unpatentable over KIM et al. ('061), CHAO et al. and YAMAMOTO on claim 18 is maintained.

As to Claim 18, the disclosure of KIM et al. ('061) in view of CHAO et al. as discussed above in claims 1 and 21 is incorporated herein. The combination of KIM et al. ('061) and CHAO et al. does not expressly disclose the limitation of a means for discharging or storing electricity and provided with supply means for an oxidizer, preferably in the form of an air pump.

However, YAMAMOTO teaches a hybrid fuel cell system which comprises a storage battery (Abstract). An auxiliary controller for the fuel cell and an output current controller for controlling the output current drawn form the fuel cell is provided so that the storage battery can be charged for recovery within the shortest possible time (Abstract). YAMAMOTO also teaches a supply air blower **9** for providing air to the fuel cell **3** (col. 3, line 55-col. 4, line 5 and Figure 1). At the time of the invention, a person having ordinary skill in the art would have found it

obvious to modify the biofuel cell device of KIM et al. (‘061) and CHAO et al. with an air blower so as to effectively provide the fuel cell with air, as taught by YAMAMOTO et al. (col. 3, line 55-col. 4, line 5 and Figure 1). Also, a person having ordinary skill in the art would have been motivated to incorporate a storage battery so that the biofuel cell system can be useful as a power supply in applications subject to sudden load fluctuations in power demand, as suggested by YAMAMOTO (Abstract).

14. The claim rejections under 35 U.S.C. 103(a) as being unpatentable over KIM et al. (‘061), CHAO et al. and YING et al. on claim 22 is maintained.

As to Claim 22, the disclose of KIM et al. (‘061) in view of CHAO et al. as discussed above for claims 1 and 21 are incorporated herein. KIM in view of CHAO et al. does not expressly disclose the limitation of a kit for processing organic waste wherein the partition wall is of polyurethane foam.

However, YING et al. teaches a separator for a fuel cell which employs a protective coating layer comprising suitable polymers such as polyurethanes (col. 13, lines 52-59).

At the time of the invention, a person having ordinary skill in the art would have found it obvious to modify the separator of the biofuel cell of KIM et al. (‘061) and CHAO et al. with a polyurethane protective coating so as to obtain an increase in toughness and flexibility without having a negative impact on the desired separator properties, as taught by YING et al. (col. 13, lines 60-65).

Response to Arguments

15. Applicant's arguments filed on May 26, 2009 have been fully considered but they are not persuasive.

Applicant's principal arguments are:

a) CHAO is not directed towards biofuel cells and therefore one would not find it obvious to substitute a non-woven fiberglass separator for the cation-exchange membrane of KIM et al. (claim 1).

In response to Applicant's arguments, please consider the following comments.

a) CHAO is analogous in that the prior art is teaching the equivalence of a non-conductive, non-ion selective separator and a cation-exchange membrane for use in fuel cells and it would be obvious to substitute known separator for the other.

Conclusion

Any inquiry concerning this communication or earlier communications from the examiner should be directed to ADAM A. ARCIERO whose telephone number is (571)270-5116. The examiner can normally be reached on Monday to Friday 8am to 5pm EST.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Dah-Wei Yuan can be reached on 571-272-1295. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

AA

/Dah-Wei D. Yuan/
Supervisory Patent Examiner, Art Unit 1795